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January 6, 2017

Mr. Jason Myers  
Director of Finance  
E-470 Public Highway Authority  
22470 East 6th Parkway  
Aurora, CO 80018

Subject: 2016 Traffic and Toll Revenue “Bring-Down” Letter, E-470 Public Highway Authority

Dear Mr. Myers:

As part of the upcoming refinancing, CDM Smith (CDMS) was requested by the E-470 Public Highway Authority (Authority) to perform a review of the traffic and toll revenue forecasts contained in our October 3, 2014 comprehensive traffic and revenue study entitled, E-470 2014 Investment Grade Traffic and Revenue Study, Final Report, and to update the forecasts contained therein, if necessary. To accomplish this, we reviewed the latest monthly traffic and revenue trend data for each mainline and ramp toll gantry through November 2016 and compared these against the aforementioned 2014 forecasts, reviewed the divergence between the estimated and actual distributions of ExpressToll and LicensePlateToll (LPT) transactions, reviewed the status of projects on the latest Denver Regional Council of Governments (DRCOG) highway improvement program versus what was contained in the 2014 study, and reviewed the latest socioeconomic and demographic forecasts, also compared against those used in the 2014 study.

### **2014 Investment Grade Traffic and Revenue Study**

Prior to the 2014 investment grade study, the Authority’s last comprehensive traffic and revenue study was prepared in September 2008. That study provided long-range traffic and revenue forecasts through 2038 for two toll collection scenarios. The first was the then existing open-road tolling system which in addition to an electronic method of toll payment referred to as ExpressToll, also included a cash method of toll payment. The second was for the current non-stop, all-electronic toll (AET) collection system which became fully operational on January 1, 2009, although cash toll collection was not eliminated until July 4, 2009 to allow for an easier transition for its customers. The study also analyzed the traffic and revenue impacts of annual toll increases versus triennial increases.

The 2014 study was intended to update the traffic and revenue forecasts associated with the existing system of toll collection and toll rates on E-470 and was performed in sufficient detail to



provide rate adjustment guidance for the Authority, if needed, and included the following objectives:

- To develop an updated profile of motorists using E-470 through origin-destination surveys, existing E-470 systemwide traffic data, and a program of traffic counts on E-470 un-tolled interchange ramps;
- To develop future year forecasts of employment, population and households for the Denver Metro Region to account for changing regional economic and demographic patterns, land use growth policies, and proposed land use development patterns, and events, such as the Great Recession;
- To estimate the potential traffic diversion in response to programmed toll rate increases;
- To develop 30-year traffic and revenue forecasts through year 2043; and
- To evaluate future mainline operating conditions.

To satisfy the intended objectives, the traffic and revenue forecasts were prepared based on a study work program which included:

- An origin-destination survey to identify actual travel patterns and trip characteristics of E-470 customers;
- An independent review of economic growth forecasts in the E-470 corridor to assess the reasonableness of regional growth assumptions used in the regional travel demand model;
- Development of an updated traffic model;
- A toll rate sensitivity analysis to provide a measure of revenue potential under higher toll rates; and
- A level of service analysis to identify when future capital improvements to the E-470 mainline may be required to maintain desired levels of service, thereby retaining the competitive travel advantages of E-470 over toll-free alternatives.

### **Actual versus Estimated Transactions and Gross Toll Revenue (2014 – 2016)**

Table 1 provides a comparison of the forecasted and actual transactions and gross toll revenue from 2014 through 2016 year-to-date (YTD). Since 2014, actual transactions have exceeded prior forecasts by an average of 5.3 percent. This was primarily due to the greater than expected traffic growth, most likely resulting from the continued recovery from the Great Recession and the significant reductions in gasoline prices. Actual year-over-year growth in systemwide transactions was 12.4 percent in 2015 and 7.5 percent in 2016 YTD. This is compared against the 8.0 percent and 4.0 percent respective growth rates assumed in the 2014 study.

**Table 1**  
**Estimated Versus Actual Annual Transactions and Toll Revenue <sup>(1)</sup>**

| Year                    | Transactions (000s)      |                       |                    | Revenue (000s)                 |                             |                    |
|-------------------------|--------------------------|-----------------------|--------------------|--------------------------------|-----------------------------|--------------------|
|                         | Estimated <sup>(1)</sup> | Actual <sup>(2)</sup> | Percent Difference | Estimated <sup>(1)</sup> Gross | Actual <sup>(2)</sup> Gross | Percent Difference |
| 2014                    | 65,520                   | 66,365                | 1.3                | \$ 171,380                     | \$ 177,697                  | 3.7                |
| 2015                    | 70,787                   | 74,609                | 5.4                | \$ 188,066                     | \$ 206,171                  | 9.6                |
| 2016 YTD <sup>(3)</sup> | 67,340                   | 73,457                | 9.1                | \$ 184,877                     | \$ 210,515                  | 13.9               |
| <b>Total Since 2014</b> | <b>203,647</b>           | <b>214,431</b>        | <b>5.3</b>         | <b>\$ 544,323</b>              | <b>\$ 594,383</b>           | <b>9.2</b>         |

<sup>(1)</sup> All estimated figures shown in this table are from the October 3, 2014 E-470 Traffic and Revenue Study.  
<sup>(2)</sup> Actual Transactions and toll revenue through November 30, 2016.  
<sup>(3)</sup> 2016 transactions and revenue estimates have been adjusted to match year-to-date (YTD) through November by dividing estimated annual transactions and revenue totals by 366 and multiplying by 335.

Gross toll revenues have exceeded forecasts by an average of 9.2 percent since 2014. This is likely the result of two main factors. First, the actual ExpressToll participation rate since 2014 was slightly lower than that forecasted. Systemwide ExpressToll participation rates in 2015 and 2016 were forecasted at 70.5 percent and 70.9 percent, respectively, based on trends observed at the time of the 2014 study. Actual ExpressToll participation rates were 67.4 percent and 69.1 percent, based on actual data through November 2016 provided by the Authority. Second, the actual percentage of commercial vehicles at the mainline toll gantries was 4.2 percent in 2015 and 4.7 percent in 2016 YTD. In the 2014 study, the percentage of commercial vehicles at the mainline toll gantries was assumed to be 2.9 percent for 2015 and 2.8 percent for 2016. These two differences had the effect of increasing average toll rates above those assumed in the 2014 study, resulting in higher actual gross toll revenue.

### Trends in Monthly Toll Transactions

Table 2 presents a comparison of monthly transaction trends from January 2010 through November 2016, the last month for which actual transaction data was available. Following the negative impacts of the Great Recession of 2008-2009, transactions on E-470 returned to consistent positive growth in 2010 and overall transaction growth in 2011. The 1.5 percent annual increase in 2011 over 2010 was tempered by more modest increases ranging between 0.5 to -0.9 percent

**Table 2**  
**Trends in Monthly Toll Transactions**

| Month        | 2010              | Percent Change | 2011 <sup>(2)</sup> | Percent Change | 2012 <sup>(1)(3)</sup> | Percent Change | 2013 <sup>(4)</sup> | Percent Change | 2014 <sup>(5)</sup> | Percent Change | 2015 <sup>(6)</sup> | Percent Change <sup>(8)</sup> | 2016 <sup>(1)(7)</sup> |
|--------------|-------------------|----------------|---------------------|----------------|------------------------|----------------|---------------------|----------------|---------------------|----------------|---------------------|-------------------------------|------------------------|
| January      | 3,641,051         | 5.1            | 3,825,889           | 1.1            | 3,868,862              | 7.1            | 4,144,884           | 12.7           | 4,672,356           | 12.1           | 5,238,434           | 8.4                           | 5,676,018              |
| February     | 3,408,374         | 4.0            | 3,545,212           | 3.9            | 3,683,550              | 3.7            | 3,818,348           | 12.5           | 4,295,331           | 12.5           | 4,833,823           | 14.2                          | 5,519,275              |
| March        | 4,033,562         | 4.4            | 4,209,612           | 2.0            | 4,295,232              | 3.9            | 4,464,028           | 12.4           | 5,017,765           | 16.2           | 5,832,879           | 7.0                           | 6,240,595              |
| April        | 4,031,699         | 1.6            | 4,097,759           | 3.4            | 4,238,073              | 6.1            | 4,494,953           | 13.6           | 5,106,117           | 16.3           | 5,936,048           | 3.6                           | 6,148,120              |
| May          | 4,437,748         | 2.0            | 4,525,204           | 6.7            | 4,828,130              | 8.1            | 5,219,608           | 11.1           | 5,797,739           | 10.8           | 6,425,750           | 8.4                           | 6,965,986              |
| June         | 4,629,859         | 0.4            | 4,648,748           | 5.6            | 4,911,112              | 5.3            | 5,172,082           | 14.1           | 5,900,658           | 14.5           | 6,757,614           | 9.0                           | 7,366,087              |
| July         | 4,802,044         | 0.8            | 4,842,067           | 2.3            | 4,951,799              | 9.3            | 5,414,329           | 15.9           | 6,274,271           | 13.1           | 7,098,100           | 2.9                           | 7,303,013              |
| August       | 4,800,413         | 2.0            | 4,897,862           | 5.1            | 5,146,202              | 8.8            | 5,599,596           | 11.7           | 6,251,950           | 11.4           | 6,965,830           | 7.6                           | 7,494,268              |
| September    | 4,491,207         | 0.7            | 4,523,215           | 0.6            | 4,551,822              | 10.9           | 5,048,841           | 15.4           | 5,824,660           | 12.7           | 6,563,755           | 7.8                           | 7,078,546              |
| October      | 4,541,323         | (0.9)          | 4,500,452           | 5.3            | 4,737,218              | 10.9           | 5,254,092           | 17.6           | 6,180,883           | 8.8            | 6,723,697           | 4.9                           | 7,053,603              |
| November     | 4,226,940         | (0.9)          | 4,188,321           | 5.4            | 4,416,214              | 8.3            | 4,783,549           | 13.0           | 5,405,976           | 10.6           | 5,978,641           | 10.6                          | 6,611,599              |
| December     | 4,253,721         | 0.5            | 4,276,045           | 1.4            | 4,337,602              | 15.0           | 4,988,422           | 13.0           | 5,637,332           | 10.9           | 6,254,476           | -                             | -                      |
| <b>Total</b> | <b>51,297,941</b> | <b>1.5</b>     | <b>52,080,386</b>   | <b>3.6</b>     | <b>53,965,816</b>      | <b>8.2</b>     | <b>58,402,732</b>   | <b>13.6</b>    | <b>66,365,038</b>   | <b>12.4</b>    | <b>74,609,047</b>   | <b>7.5</b>                    | <b>73,457,110</b>      |

Source: E-470 Public Highway Authority, 2016.

(1) Leap Year.

(2) Tolls increased at Toll Gantry A from \$2.00 to \$2.15 and at Toll Gantries B, C, D and E from \$2.25 to \$2.40 on January 1, 2011. Ramp toll gantries increased to \$0.95. Additionally, the toll differential between ExpressToll and License Plate Toll was increased from \$0.25 to 25 percent.

(3) Tolls increased at Toll Gantry from \$2.15 to \$2.25 and at Toll Gantries B, C, D and E from \$2.40 to \$2.50 on January 1, 2012. Ramp toll gantries increased to \$1.00.

(4) Tolls increased at Toll Gantry A from \$2.25 to \$2.35 and at Toll Gantries B, C, D and E from \$2.50 to \$2.60 on January 1, 2013. Ramp toll gantries increased to \$1.05.

(5) Tolls increased at Toll Gantry A from \$2.35 to \$2.45 and at Toll Gantries B, C, D and E from \$2.60 to \$2.70 on January 1, 2014. Ramp toll gantries increased to \$1.10.

(6) Tolls increased at Toll Gantry A from \$2.45 to \$2.50 and at Toll Gantries B, C, D and E from \$2.70 to \$2.75 on January 1, 2015. Ramp toll gantries increased to \$1.15.

(7) Tolls increased at Toll Gantry A from \$2.50 to \$2.60 and at Toll Gantries B, C, D and E from \$2.75 to \$2.85 on January 1, 2016. Ramp toll gantries increased to \$1.20.

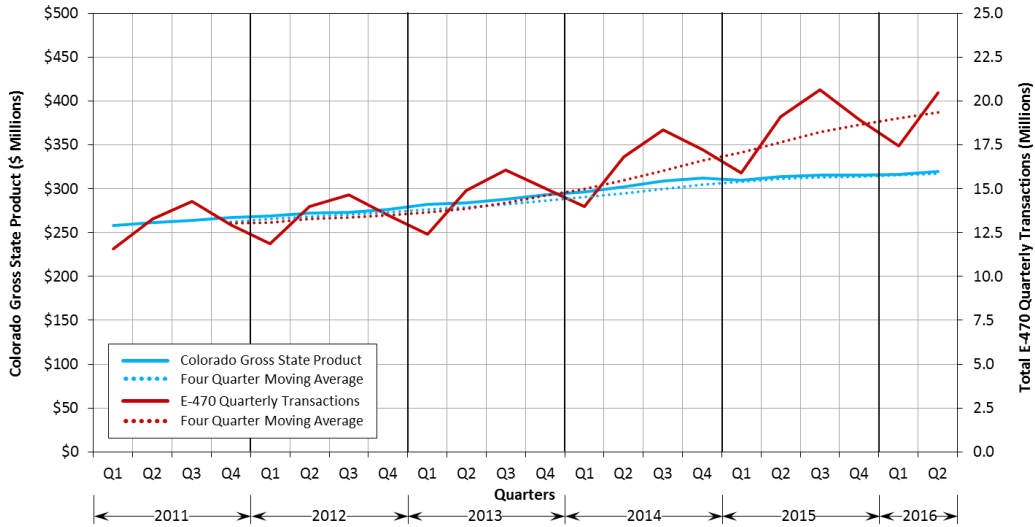
(8) Represents the percent change in 2016 year-to-date versus the same period in 2015.

during the final quarter of 2011. Transactions continued to grow in 2012, increasing by 3.6 percent to 54.0 million, just shy of the 2007 pre-recession high of 54.1 million transactions. The annual growth rate in 2012 incorporates both the slight positive impacts of the additional day due to the leap year as well as the negative impacts of toll rate increases in 2011 and 2012.

During the first six months of 2013, transactions grew at a rate of 5.8 percent over the same period during the prior year. However, beginning in July 2013, transaction growth accelerated significantly, averaging 10.6 percent over the last six months, resulting in an average total annual increase of 8.2 percent over 2012. Except for October 2015 and January 2016, the double-digit year-over-year transaction growth continued through to February 2016. The acceleration in transaction growth between 2010 and 2015 was likely due to the gradual economic recovery from Great Recession consistent with increases in national and state GDP over this period, as illustrated in Figure 1. Accelerated transaction growth correlated with increased growth in state GDP, beginning as early as 2011. In late 2014, transaction growth on E-470 began to accelerate significantly, diverging from the growth rates in state GDP. This accelerated growth coincided with the significant reduction of gasoline prices both in Colorado and the nation as illustrated in Figure 2. Average Colorado gasoline prices decreased from an average of \$3.39 in 2014 to \$2.40 in 2015, a reduction of almost 30 percent. At the same time, transactions on E-470 continued to experience double-digit growth. Annual transaction growth in 2014 and 2015 was 13.6 percent and 12.4

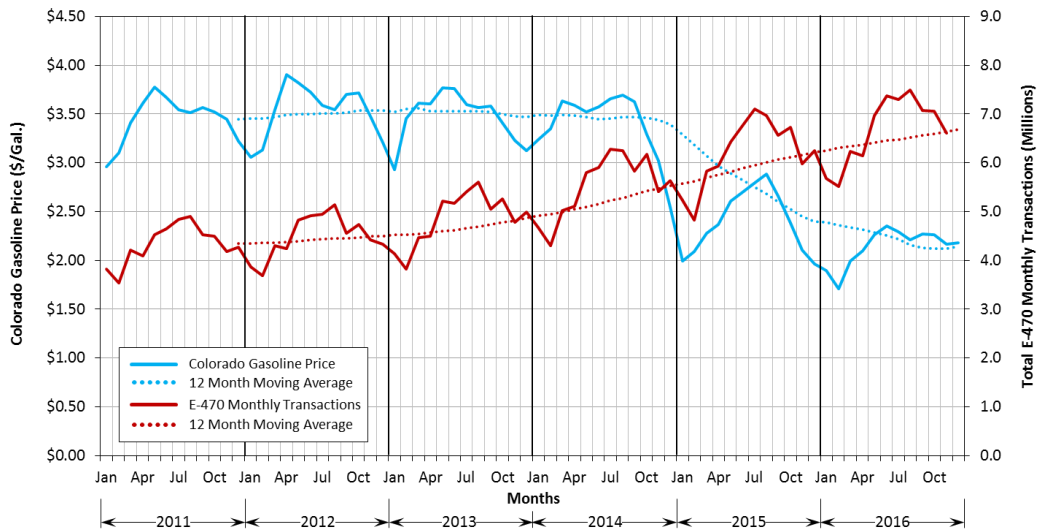
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**Figure 1**  
**Comparison of Quarterly Colorado State Product and E-470 Toll Transactions, 2011-2016**



Source: US Bureau of Economic Analysis; E-470 Authority.

**Figure 2**  
**Comparison of Monthly Colorado Gasoline Prices and E-470 Toll Transactions, 2011-2016**



Source: US Energy Information Administration; E-470 Authority.



percent, respectively, with October 2015 experiencing the only year-over-year growth below 10 percent. This level of growth occurred despite annual toll rate increases over the same period.

Monthly transaction growth in 2016 has remained robust, although generally at slightly lower, single-digit rates. Average growth for the first half of the year was 8.3 percent, aided in part by the additional leap year day in February. A strong growth trend has continued throughout the second half of 2016, with significant increases in November of 10.6 percent. Year-to-date growth in 2016 is 7.5 percent. Adjusting transactions to account for the additional leap year day would effectively reduce growth in February to 9.7 percent, and year-to-date annual growth to 7.2 percent.

### **Trends and Assumptions in ExpressToll and LicensePlateToll Transactions**

Table 3 provides a summary of monthly toll transaction trends by method of toll payment. While data is presented from January 2014 through November 2016, the last month for which data was available, we have assessed ExpressToll market penetration rates beginning with the first full year of ExpressToll, all-electronic tolling in 2010. The data indicates that overall levels of ExpressToll market penetration had remained relatively stable between 2010 and 2013, accounted for between 70 to 73 percent of all transactions. However, ExpressToll market penetration declined to 68 percent and 67 percent in 2014 and 2015, respectively. This was primarily because LPT transactions were growing at a faster rate than ExpressToll transactions. These declines occurred despite an increase in the toll differential between ExpressToll and LPT and several overall toll increases. The faster growth in LPT transactions was speculated to be the result of new system users coming from the developing areas in Aurora and Adams County who had yet to register for ExpressToll, in addition to the return of some of the less frequent non-resident, recreational or discretionary customers lost during the recession. However, 2016 saw an increase in ExpressToll market penetration to 69 percent. It is believed that the expansion of the managed lane concept in the Denver region has been a contributing factor for the increase. It is believed that penetration rates will continue to rise modestly in the future as the managed lane concept continues to expand along the North I-25, I-70 and C-470 travel corridors.

Table 4 presents ExpressToll/LicensePlateToll distributions used to develop the transactions and revenue estimates in the 2014 investment grade study and those used in this update. The revised distributions are based on actual 2010 through November 2016 percentages, and the assumption that the existing LPT surcharge percent is retained throughout the forecast period.

### **Actual and Assumed ExpressToll and LicensePlateToll Rates**

The toll rate assumptions presented in Table 5 are those assumed in the 2014 investment grade study. These rate assumptions have not changed and remain appropriate for use in this traffic and revenue update.

**Table 3**  
**Trends in Monthly Toll Transactions**  
**by Method of Payment**

| Month               | 2014         |         |              |         |              |         |
|---------------------|--------------|---------|--------------|---------|--------------|---------|
|                     | ExpressToll  |         | LPT          |         | Total        |         |
|                     | Transactions | Percent | Transactions | Percent | Transactions | Percent |
| January             | 3,258,369    | 69.7    | 1,413,987    | 30.3    | 4,672,356    | 100.0   |
| February            | 3,037,865    | 70.7    | 1,257,466    | 29.3    | 4,295,331    | 100.0   |
| March               | 3,506,601    | 69.9    | 1,511,164    | 30.1    | 5,017,765    | 100.0   |
| April               | 3,611,731    | 70.7    | 1,494,386    | 29.3    | 5,106,117    | 100.0   |
| May                 | 3,965,628    | 68.4    | 1,832,111    | 31.6    | 5,797,739    | 100.0   |
| June                | 3,958,175    | 67.1    | 1,942,483    | 32.9    | 5,900,658    | 100.0   |
| July                | 4,116,713    | 65.6    | 2,157,558    | 34.4    | 6,274,271    | 100.0   |
| August              | 4,090,519    | 65.4    | 2,161,431    | 34.6    | 6,251,950    | 100.0   |
| September           | 3,943,755    | 67.7    | 1,880,905    | 32.3    | 5,824,660    | 100.0   |
| October             | 4,237,951    | 68.6    | 1,942,932    | 31.4    | 6,180,883    | 100.0   |
| November            | 3,626,069    | 67.1    | 1,779,907    | 32.9    | 5,405,976    | 100.0   |
| December            | 3,759,465    | 66.7    | 1,877,867    | 33.3    | 5,637,332    | 100.0   |
| January to November | 41,353,376   | 68.1    | 19,374,330   | 31.9    | 60,727,706   | 100.0   |
| Total Year          | 45,112,841   | 68.0    | 21,252,197   | 32.0    | 66,365,038   | 100.0   |

| Month               | 2015         |         |              |         |              |         |
|---------------------|--------------|---------|--------------|---------|--------------|---------|
|                     | ExpressToll  |         | LPT          |         | Total        |         |
|                     | Transactions | Percent | Transactions | Percent | Transactions | Percent |
| January             | 3,540,734    | 67.6    | 1,697,700    | 32.4    | 5,238,434    | 100.0   |
| February            | 3,295,435    | 68.2    | 1,538,388    | 31.8    | 4,833,823    | 100.0   |
| March               | 3,958,117    | 67.9    | 1,874,762    | 32.1    | 5,832,879    | 100.0   |
| April               | 4,079,508    | 68.7    | 1,856,540    | 31.3    | 5,936,048    | 100.0   |
| May                 | 4,320,654    | 67.2    | 2,105,096    | 32.8    | 6,425,750    | 100.0   |
| June                | 4,464,455    | 66.1    | 2,293,159    | 33.9    | 6,757,614    | 100.0   |
| July                | 4,609,177    | 64.9    | 2,488,923    | 35.1    | 7,098,100    | 100.0   |
| August              | 4,598,117    | 66.0    | 2,367,713    | 34.0    | 6,965,830    | 100.0   |
| September           | 4,430,492    | 67.5    | 2,133,263    | 32.5    | 6,563,755    | 100.0   |
| October             | 4,656,291    | 69.3    | 2,067,406    | 30.7    | 6,723,697    | 100.0   |
| November            | 4,110,564    | 68.8    | 1,868,077    | 31.2    | 5,978,641    | 100.0   |
| December            | 4,238,181    | 67.8    | 2,016,295    | 32.2    | 6,254,476    | 100.0   |
| January to November | 46,063,544   | 67.4    | 22,291,027   | 32.6    | 68,354,571   | 100.0   |
| Total Year          | 50,301,725   | 67.4    | 24,307,322   | 32.6    | 74,609,047   | 100.0   |

| Month               | 2016         |         |              |         |              |         |
|---------------------|--------------|---------|--------------|---------|--------------|---------|
|                     | ExpressToll  |         | LPT          |         | Total        |         |
|                     | Transactions | Percent | Transactions | Percent | Transactions | Percent |
| January             | 3,966,059    | 69.9    | 1,709,959    | 30.1    | 5,676,018    | 100.0   |
| February            | 3,871,382    | 70.1    | 1,647,893    | 29.9    | 5,519,275    | 100.0   |
| March               | 4,343,032    | 69.6    | 1,897,563    | 30.4    | 6,240,595    | 100.0   |
| April               | 4,329,810    | 70.4    | 1,818,310    | 29.6    | 6,148,120    | 100.0   |
| May                 | 4,874,767    | 70.0    | 2,091,219    | 30.0    | 6,965,986    | 100.0   |
| June                | 5,015,445    | 68.1    | 2,350,642    | 31.9    | 7,366,087    | 100.0   |
| July                | 4,863,023    | 66.6    | 2,439,990    | 33.4    | 7,303,013    | 100.0   |
| August              | 5,111,717    | 68.2    | 2,382,551    | 31.8    | 7,494,268    | 100.0   |
| September           | 4,891,222    | 69.1    | 2,187,324    | 30.9    | 7,078,546    | 100.0   |
| October             | 4,903,690    | 69.5    | 2,149,913    | 30.5    | 7,053,603    | 100.0   |
| November            | 4,624,176    | 69.9    | 1,987,423    | 30.1    | 6,611,599    | 100.0   |
| December            | -            | -       | -            | -       | -            | -       |
| January to November | 50,794,323   | 69.1    | 22,662,787   | 30.9    | 73,457,110   | 100.0   |
| Total Year          | 50,794,323   | 69.1    | 22,662,787   | 30.9    | 73,457,110   | 100.0   |

Source: E-470 Authority



**Table 4**  
**ExpressToll and LicensePlateToll Percentages**

| Year               | 2014 Investment Grade<br>Study Assumptions <sup>(1)</sup> |              | Revised Assumptions <sup>(2)</sup> |              |
|--------------------|---|--------------|------------------------------------|--------------|
|                    | ExpressToll   | LicensePlate | ExpressToll                        | LicensePlate |
| 2010               | 73  | 27           | 73                                 | 27           |
| 2011               | 73  | 27           | 73                                 | 27           |
| 2012               | 72  | 28           | 72                                 | 28           |
| 2013               | 70  | 30           | 70                                 | 30           |
| 2014               | 70  | 30           | 68                                 | 32           |
| 2015               | 71  | 29           | 67                                 | 33           |
| 2016               | 71  | 29           | 69                                 | 31           |
| 2018               | 72  | 28           | 69                                 | 31           |
| 2021               | 73  | 27           | 70                                 | 30           |
| 2035 and<br>Beyond | 73  | 27           | 70                                 | 30           |

<sup>(1)</sup> 2014 Study assumptions based on actual transaction data through April 2014.  
<sup>(2)</sup> Revised assumptions based on actual transaction data through November 2016.

- Actuals.

**Table 5**  
**Actual and Assumed ExpressToll and LicensePlateToll  
Passenger Car-Based Tolls**

| Year                | ExpressToll     |            |                | LicensePlateToll |            |                |
|---------------------|-----------------|------------|----------------|------------------|------------|----------------|
|                     | Mainline Plazas |            | Ramp<br>Plazas | Mainline Plazas  |            | Ramp<br>Plazas |
|                     | A               | B, C, D, E |                | A                | B, C, D, E |                |
| 2016 <sup>(1)</sup> | \$ 2.60         | \$ 2.85    | \$ 1.20        | \$ 3.25          | \$ 3.55    | \$ 1.50        |
| 2017                | 2.70            | 2.95       | 1.25           | 3.40             | 3.70       | 1.55           |
| 2018                | 2.75            | 3.00       | 1.30           | 3.45             | 3.75       | 1.65           |
| 2019                | 2.85            | 3.10       | 1.35           | 3.55             | 3.90       | 1.70           |
| 2020                | 2.95            | 3.20       | 1.40           | 3.70             | 4.00       | 1.75           |
| 2021                | 3.00            | 3.25       | 1.45           | 3.75             | 4.05       | 1.80           |

<sup>(1)</sup> Actual.



## **Review of the Highway Improvement Program**

As part of the comprehensive traffic and toll revenue study performed in 2014, a detailed review was conducted of the proposed highway improvements for the immediate E-470 corridor and along principal competing and complementary freeways. Changes to the project listing during the past two years include an addition of five years to the planning horizon, lengthening the planning period from 2035 to 2040. A review of those plans was conducted by subconsultant, Felsburg Holt & Ullevig (FHU) as part of this update. At the same time, a review of the Authority's proposed capital program was conducted to verify improvement assumptions from the 2014 study.

Significant projects completed since the 2014 study include:

- Construction of the Quebec Street Interchange on E-470;
- The new Hess Road connection from I-25 to Chambers Road;
- A new section of 96th Avenue between Buckley Road and Tower Road; and
- The completion of additional through lanes on I-225 from Parker Road to Mississippi Avenue.

While these projects were assumed to have minor near-term impacts on E-470, it was also assumed that any impacts generated were now included in the current actual E-470 traffic and revenue trends on which the current update is based. Most notably, the Quebec Street interchange opened December 2014 and included two new tolling points. Existing transaction data from these new tolling points and from neighboring interchanges formed the basis for the development of assumed normal growth trends at the new Quebec Street location.

Several significant projects have been added to, removed from, delayed or accelerated within the DRCOG highway improvement program. Future projects that could potentially negatively impact traffic on E-470 include:

- Removal of assumed widening of Hess Road from I-25 to Chambers Road;
- Changes to the project boundaries and schedules of the I-70 widening from I-270 to Havana Street;
- The addition of managed lanes along I-70 between I-25 and Chambers Road;
- Additional widenings to Broncos Parkway;
- The addition of general purpose and managed lanes along I-25 north of US 36; and
- The addition of the southbound ramp from Tower Road onto Pena Boulevard;

Significant project changes within the DRCOG model that could potentially impact future traffic on E-470 positively include:

- The changes to the project limits, recommended improvements, and phasing of the C-470 projects, including the addition of managed lanes;
- A delay to the Tower Road widening between Pena Boulevard and 104th Avenue from 2024 to 2034; and
- Interchange capacity improvements along I-225 between I-25 and Yosemite Street.

The traffic and revenue impacts of these improvements have been accounted for as part of the “normal growth” estimates. Additionally, the changes to the assumed opening of various new interchanges on E-470 were reviewed and incorporated into the future year forecast, including the acceleration of the East 48<sup>th</sup> Avenue and East 88<sup>th</sup> Avenue interchanges from 2025 and 2035, respectively, to 2021, the addition of the I-76 interchange buildout in 2025, and the delay of the East 112<sup>th</sup> Avenue interchange construction from 2035 to 2040. Impacts for these changes to the highway improvement assumptions were estimated based on traffic impacts developed in prior new interchange traffic and revenue studies.

### **Review of Regional Socioeconomic/Demographic Forecasts**

The United States continues to recover from the most severe recession since the Great Depression. Colorado, among a few states in the country achieved its 2008 (pre-recession) labor force level in 2013. Among the State’s regions, the Denver Metro Area is leading this statewide recovery. The recession had had such a large impact on the economy and growth in the country, and in Colorado, that many of the earlier growth forecasts for the Denver Metro Area not only overestimated the amount and rate of growth in the Metro Area over the next twenty years, but also did not anticipate the volatility and duration of the recession. For this “update” letter, a review of historic conditions and recent regional socioeconomic and demographic forecasts was conducted to assess if any changes had occurred due to the recession that would impact traffic growth in the E-470 corridor.

A similar, yet more detailed, analysis was conducted in 2014 for the E-470 2014 Investment Grade Traffic and Revenue Study and was based on prior forecasts developed by DRCOG. CDM Smith assumed that, in lieu of revising the travel demand model and performing new traffic assignments, the future year growth rate assumptions developed during the 2014 E-470 Investment Grade Traffic and Revenue Study were still valid for the longer-term forecast period beyond 2018.

DRCOG recently released revisions to its 2035 socioeconomic/demographic forecasts in which their 2015 and 2035 employment estimates were increased. Table 6 presents a comparison of the revised population and employment forecasts for the 11-County Denver Metro Area used in the E-470 2014 Investment Grade Traffic and Revenue Study and the current revised forecasts.

**Table 6**  
**11-County Denver Metro Revised Forecasts**

| Forecast  | 2015      | 2035      |
|---|-----------|-----------|
| <b>Population <sup>(1)</sup></b>  |           |           |
| EPS Adjusted - 2014   | 3,137,190 | 4,025,415 |
| EPS Adjusted - 2016   | 3,137,190 | 4,025,415 |
| Percent Difference  | -         | -         |
| <b>Employment <sup>(1)</sup></b>  |           |           |
| EPS Adjusted - 2014   | 1,457,746 | 1,909,979 |
| EPS Adjusted - 2016   | 1,568,331 | 2,042,836 |
|   | 7.6       | 7.0       |
| Source: Economic and Planning Systems (EPS).  |           |           |
| <sup>(1)</sup> Data shown are estimates developed by EPS in 2014 as part of the E-470 Investment Grade Traffic and Revenue Study and in 2016 for this update. |           |           |

As shown, the 2015 and 2035 employment forecasts for the 11-County Denver Metro Area were increased by 7.6 percent and 7.0 percent, respectively. This revision incorporates the positive impacts of the economic recovery and lower gasoline prices. These changes to the DRCOG 2015 and 2035 forecasts were reviewed in light of the recent transaction growth on E-470, which incorporates the impacts of the economic recession and reduced gasoline prices. It was assumed that the increased employment levels forecasted by DRCOG has been accounted for by re-benchmarking the future year forecasts to current transaction levels. However, it is possible that some of the future growth assumed in the 2014 study may have been brought forward as part of the recent high transaction growth. Based on this assumption, transaction growth rate forecasts from the 2014 study beyond 2025 were reduced by 10 percent.

### **Updated Transaction and Toll Revenue Estimates**

The first step in the development of the updated forecasts was to compare the latest actual YTD traffic and revenue data by tolling location (mainline and ramp gantries) against the forecasts developed in the E-470 2014 Investment Grade Traffic and Revenue Study. Particular attention was paid to the divergence between the estimated distribution of ExpressToll and LPT transactions in our prior forecast versus the actual distributions of the past two years. The distribution of vehicles by class was also reviewed and compared against the assumptions in the prior study.

The resulting revised annual transaction and gross and net toll revenue estimates are provided in Table 7. In the short term, transactions on E-470 are estimated to increase from 74.6 million in 2015 to 88.1 million in 2018. This places the revised transaction estimates for the total E-470 system for 2018 over 9.0 million transactions higher than the prior estimates principally due to higher actual and forecasted short-term growth than that which was previously forecasted between 2014 and 2018. Systemwide transactions are estimated to reach 97.5 million by 2021 and 163.1 million by 2040. These represent a 10.6 percent and 6.8 percent increase over the prior forecasts, respectively. Overall transaction growth during the 2017-2046 forecast period is estimated to average 2.9 percent per annum, including the impacts of the planned toll increases.

Revenues are also estimated to be impacted by the changes to the study assumptions. Between 2015 and 2018, gross toll revenue is estimated to increase from \$205.3 million to \$261.6 million. The differences in the toll revenue forecasts between the 2014 Investment Grade Traffic and Revenue Study and the current update are the result of the impacts of revised traffic growth, updated highway improvement assumptions, and changes to the assumed ExpressToll participation rate based on recent actual experience. Current revenue estimates are 14.7 percent higher in 2018 compared with the 2014 forecast. Systemwide gross toll revenues are estimated to be \$311.2 million in 2021 and \$738.6 million by 2040. The current 2021 forecasts are 13.2 percent higher than those prepared in the 2014 study and 10.3 percent higher in 2040. Overall gross toll revenue growth during the 2017-2046 forecast period is estimated to average 4.8 percent per annum, including the impacts of the planned toll increases and assumed CPI-based annual toll rate increases after 2021. This is comparable to the average annual growth in gross toll revenue of 5.0 percent estimated between 2017 and 2043 in the 2014 Investment Grade Traffic and Revenue Study.

Using information provided by E-470, estimates of uncollectable and net toll revenues have also been provided. Uncollectable revenues consist of "rejected" transactions where the license plate cannot be billed and "LPT unpaid" transactions where the license plate can be read, and the customer has been billed, but the bill is unpaid. Based on data from all of calendar year 2015, rejected transactions represent 11.8 percent of gross toll revenue, while LPT unpaid transactions represent 3.9 percent of gross toll revenue. The total estimated uncollectable rate is 15.7 percent of gross toll revenue. This uncollectable rate will most likely be reduced in future years through improvements to technology and enforcement. It has therefore been assumed that the uncollectable rate will drop from the current rate of 15.7 percent in 2015 to 9.5 percent by 2040. In 2018, total net toll revenue is estimated at \$222.6 million. Net toll revenue is estimated to increase to \$268.5 million by 2021 and to \$668.3 million by 2040.

**Table 7**  
**Estimated Annual Toll Transactions and Revenue (in Thousands)**

| Year                    | Current Update |                      |                              |            | 2014 Investment Grade Study |                    | Difference <sup>(1)</sup> |                    |
|-------------------------|----------------|----------------------|------------------------------|------------|-----------------------------|--------------------|---------------------------|--------------------|
|                         | Transactions   | Toll Revenue         |                              |            | Transactions                | Gross Toll Revenue | Transactions              | Gross Toll Revenue |
|                         |                | Gross <sup>(2)</sup> | Uncollectable <sup>(3)</sup> | Net        |                             |                    |                           |                    |
| 2015 <sup>(4)</sup>     | 74,609         | \$ 205,353           | \$ (32,313)                  | \$ 173,040 | 70,787                      | \$ 188,066         | 3,822                     | \$ 17,287          |
| 2016 <sup>(4)(5)</sup>  | 79,821         | 226,195              | (35,520)                     | 190,675    | 73,637                      | 201,985            | 6,184                     | 24,210             |
| 2017                    | 84,118         | 245,276              | (37,341)                     | 207,935    | 76,156                      | 216,338            | 7,962                     | 28,938             |
| 2018 <sup>(6)</sup>     | 88,129         | 261,589              | (38,971)                     | 222,618    | 79,017                      | 228,136            | 9,112                     | 33,453             |
| 2019                    | 91,373         | 279,661              | (40,603)                     | 239,058    | 81,936                      | 244,237            | 9,437                     | 35,424             |
| 2020 <sup>(5)</sup>     | 95,013         | 298,935              | (42,111)                     | 256,824    | 85,235                      | 261,494            | 9,778                     | 37,441             |
| 2021 <sup>(7)</sup>     | 97,535         | 311,183              | (42,646)                     | 268,537    | 88,149                      | 274,887            | 9,386                     | 36,296             |
| 2022                    | 98,109         | 319,215              | (42,755)                     | 276,460    | 88,689                      | 281,893            | 9,420                     | 37,322             |
| 2023                    | 98,856         | 327,718              | (42,809)                     | 284,909    | 89,393                      | 289,310            | 9,463                     | 38,408             |
| 2024 <sup>(5)</sup>     | 100,043        | 337,593              | (43,145)                     | 294,448    | 90,531                      | 298,038            | 9,512                     | 39,555             |
| 2025 <sup>(8)</sup>     | 102,258        | 348,923              | (43,951)                     | 304,972    | 92,936                      | 309,408            | 9,322                     | 39,515             |
| 2026                    | 104,791        | 364,440              | (44,987)                     | 319,453    | 95,589                      | 324,441            | 9,202                     | 39,999             |
| 2027                    | 107,404        | 380,745              | (46,176)                     | 334,569    | 98,328                      | 340,254            | 9,076                     | 40,491             |
| 2028 <sup>(5)</sup>     | 110,403        | 398,859              | (47,451)                     | 351,408    | 101,464                     | 357,827            | 8,939                     | 41,032             |
| 2029                    | 112,887        | 415,913              | (48,569)                     | 367,344    | 104,079                     | 374,343            | 8,808                     | 41,570             |
| 2030                    | 115,763        | 434,736              | (49,813)                     | 384,923    | 107,095                     | 392,584            | 8,668                     | 42,152             |
| 2031                    | 118,733        | 454,652              | (51,186)                     | 403,466    | 110,212                     | 411,903            | 8,521                     | 42,749             |
| 2032 <sup>(5)</sup>     | 122,135        | 476,564              | (52,612)                     | 423,952    | 113,776                     | 433,210            | 8,359                     | 43,354             |
| 2033                    | 124,971        | 497,527              | (53,884)                     | 443,643    | 116,761                     | 453,501            | 8,210                     | 44,026             |
| 2034                    | 128,247        | 520,491              | (55,321)                     | 465,170    | 120,201                     | 475,763            | 8,046                     | 44,728             |
| 2035 <sup>(9)</sup>     | 141,446        | 583,435              | (61,091)                     | 522,344    | 131,878                     | 527,000            | 9,568                     | 56,435             |
| 2036 <sup>(5)</sup>     | 145,579        | 612,138              | (62,796)                     | 549,342    | 136,084                     | 553,863            | 9,495                     | 58,275             |
| 2037                    | 149,019        | 638,760              | (64,196)                     | 574,564    | 139,596                     | 578,756            | 9,423                     | 60,004             |
| 2038                    | 152,962        | 668,380              | (65,807)                     | 602,573    | 143,652                     | 607,173            | 9,310                     | 61,207             |
| 2039                    | 157,013        | 699,386              | (67,459)                     | 631,927    | 147,846                     | 636,640            | 9,167                     | 62,746             |
| 2040 <sup>(5)(10)</sup> | 163,056        | 738,615              | (70,305)                     | 668,310    | 152,645                     | 669,550            | 10,411                    | 69,065             |
| 2041                    | 166,934        | 770,819              | (71,874)                     | 698,945    | 156,672                     | 700,562            | 10,262                    | 70,257             |
| 2042                    | 171,377        | 806,646              | (73,678)                     | 732,968    | 161,317                     | 734,926            | 10,060                    | 71,720             |
| 2043                    | 175,942        | 844,155              | (75,529)                     | 768,626    | 166,123                     | 770,867            | 9,819                     | 73,288             |
| 2044 <sup>(5)</sup>     | 181,128        | 885,844              | (77,637)                     | 808,207    |                             |                    |                           |                    |
| 2045                    | 185,454        | 924,538              | (79,370)                     | 845,168    |                             |                    |                           |                    |
| 2046                    | 190,408        | 967,583              | (81,363)                     | 886,220    |                             |                    |                           |                    |

<sup>(1)</sup> The difference shown is between the current and previous 2014 gross revenue forecasts.

<sup>(2)</sup> Calculated based on estimated vehicle transactions and the associated toll rates.

<sup>(3)</sup> Uncollectable revenue is estimated based on leakage data provided by E-470.

<sup>(4)</sup> Actual through November 2016.

<sup>(5)</sup> Leap Year.

<sup>(6)</sup> Widening of the E-470 mainline between Parker Road and E Quincy Avenue is also assumed to open in 2018.

<sup>(7)</sup> E 48th Avenue and E 88th Avenue interchanges are assumed to open in 2021.

<sup>(8)</sup> Potomac Street interchanges, as well as completion of the I-76 interchanges are assumed to open in 2025.

<sup>(9)</sup> Completion of the I-70 interchange is assumed in 2035. Widening of the entire E-470 mainline is also assumed in 2035.

<sup>(10)</sup> E 112th Avenue interchange is assumed to open in 2040.



Mr. Jason Myers  
January 6, 2017  
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CDM Smith appreciates the important nature of this assignment and the opportunity to work with the Authority. As always, please do not hesitate to contact us with any comments and/or questions.

Respectfully submitted,

A handwritten signature in black ink that reads "Paul M. Marcella". The signature is written in a cursive style with a long, sweeping underline.

Paul M. Marcella  
Project Manager/Associate  
CDM Smith Inc.



## **Disclaimer**

Current accepted professional practices and procedures were used in the development of these traffic and revenue estimates. However, as with any forecast of the future, it should be understood that there may be differences between forecasted and actual results caused by events and circumstances beyond the control of the forecasters. In formulating its estimates, CDM Smith has reasonably relied upon the accuracy and completeness of information provided (both written and oral) by the E-470 Public Highway Authority and other local and state agencies. CDM Smith also has relied upon the reasonable assurances of some independent parties and is not aware of any facts that would make such information misleading.

CDM Smith has made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue estimates that must be considered as a whole; therefore selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the results. CDM Smith gives no opinion as to the value or merit to partial information extracted from this report.

All forecasts and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple state and local agencies, including the E-470 Public Highway Authority, the Denver Regional Council of Governments, and by independent third parties. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments, economic conditions cannot be predicted with certainty, and may affect the estimates or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that some of the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date in the report, such forward looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CDM Smith is not, and has not been, a municipal advisor as defined in Federal law (the Dodd Frank Bill) to the E-470 Public Highway Authority and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to the E-470 Public Highway Authority with respect to the information and material contained in this report. CDM Smith is not recommending and has not recommended any action to the E-470 Public Highway Authority. The E-470 Public Highway Authority should discuss the information and material contained in this report with any and all internal and external advisors that it deems appropriate before acting on this information.